# Engineering Utility Software

J. Johnston
J. Bolognese, S. Gordon, J. Kuhn, F. Tahmasebi
NASA GSFC/Code 542

FEMCI Presentation
March 9, 2000

# Outline

- Overview of presentation
- Program descriptions
  - Functionality
  - Inputs
  - Commands
  - Limitations
  - Location
  - Contact information
  - References
- Summary

# Overview

**The objective of this presentation is to provide an overview of the FEA engineering utility software available to GSFC structural analysts.**

- Input from FEMCI user's group solicited 1/2000.
- This presentation was compiled with the assistance of the program developers and users who responded to the original solicitation.
- Discussion is limited primarily to UNIX based applications developed in-house or by contractors.

# Engineering Utility Programs

- ADHSV_STRS/STRN
- FLAME
- NASGLU
- NASMET
- PCHSCAN
- RQNAS
- STOCS
- THDEF
- UAIMODAL

# ADHSV_STRS/STRN

**Functionality:** Programs to obtain stresses and strains in adhesively bonded joints. Also sorts results and generates Mathematica plot files for 3-D visualization of stress and strain fields.

**Inputs:** NASTRAN input and output files.

**Commands:** Detailed command listing available (see reference).

**Limitations:** A specific bonded joint modeling technique must be utilized. Details regarding the technique are provided on the FEMIC website and in a GSFC memorandum (see reference).

**Location:** On the FEMCI website at: http://femci.gsfc.nasa.gov/adhesive/

**Contact:** Farhad Tahmasebi/GSFC 542

**References:** "Software Tools for Analysis of Bonded Joints," F. Tahmasebi/542.1, July 28, 1999. Also at: http://femci.gsfc.nasa.gov/adhesive/

# FLAME
# (Flight Loads and Matrix Executive)

**Functionality:** Performs matrix operations and manipulations (i.e. MATLAB). Contains routines for eigenvalue extraction, transient analysis, steady-state response, and random vibration. Creates load transformation matrices (LTM's) for Craig-Bampton models. Also useful for manipulating analysis and test data.

**Inputs:** Matrices in one of the following formats: NASTRAN Output4 format (binary and ASCII), FORTRAN binary, or ASCII text.

**Commands:** Detailed command listing available. Batch mode available.

**Limitations:** No data plotting capability.

**Location:** Currently located on SGI's at /usr/local/bin/flame. Beta version (untested) available for Windows 98/NT.

**Contacts:** Kevin Brenneman/Swales
Scott Gordon/GSFC 542
Reg Mitchell/GSFC 542

# NASGLU
# (NASTRAN General LTM Utility)

**Functionality:** Program for post-processing of NASTRAN results files (UAI/MSC/COSMIC). Transfers data between NASTRAN, FLAME, FEMAP, and spreadsheets. Reads a NASTRAN output file and generates formatted (sorted, unsorted, max/min) results tables. Will also read in a binary matrix (i.e. from FLAME).

**Inputs:** NASTRAN output files (.prt,.f06,.f65c) or matrices stored as binary files.

**Commands:** Detailed command listing available through online help available during program execution.

**Limitations:** See online help file.

**Location:** On the SGI's at /usr/local/bin/nasglu

**Contacts:** Kevin Brenneman/Swales
Reg Mitchell/GSFC 542

# NASMET

**Functionality:** Utility to convert the units of a NASTRAN bulk data deck. Originally intended to convert English units to SI. Can be used to convert to a number of English and metric units. User specified conversion factors available for unsupported units.

**Inputs:** NASTRAN input file.

**Commands:** User enters the input file name, and a name for the new (converted) file. A menu then walks the user through the conversions for length, time, force, and temperature. User may also specify a value for PARAM,WTMASS.

**Limitations:** Not all NASTRAN cards supported.

**Location:** On SGI's in directory /usr/local/bin/nasmet

**Contact:** Jeff Bolognese/GSFC 542

# PCHSCAN

**Functionality:** Program for evaluating output data from a unit enforced displacement validity check. Compares output results with expected data and produces a listing of grids and elements that exceed specified limits.

**Inputs:** Punch (.pch) file containing UED output data.

**Commands:** Program prompts the user for file names, type of NASTRAN (UAI or MSC), and the UED cases analyzed.

**Limitations:** Very large files will frequently hang up the program. Tolerances are specified in English units and may not be applicable to other units.

**Location:** On the SGI's at /home/jeff/programs/pchscan15

**Contacts:** Jeff Bolognese/GSFC 542
Mark McGinnis/GSFC 542

**Reference:** http://femci.gsfc.nasa.gov/validitychecks/pchscan.html

# RQNAS

**Functionality:** A GUI for remotely submitting and monitoring jobs on Analyst and Parrot. Provides for automated transferring, submitting, inspecting, and retrieving of NASTRAN jobs.

**Inputs:** NASTRAN input file. Note that program automatically handles include statements.

**Commands:** User double clicks on a master .dat file to automatically transfer it to analyst or parrot and submit it as a NASTRAN job. Rqnas pops up a dialog box requesting the queue, and automatically modifies the time card in the .dat file. When a job is completed, double click on the job and all the files will be downloaded.

**Limitations:** Some problems with user's shell on parrot during initial setup that can be resolved in user's .cshrc file.

**Location:** ftp:/analyst.gsfc.nasa.gov/jonathan/perl /Rqnas_v1.2.zip

**Contact:** Jonathan Kuhn/GSFC 542

# STOCS
# (Structural Optical Components Shifts)

**Functionality:** Program for calculating the thermal distortions of a simple structure in a stress-free mounting condition. Intended as a first cut before creating a detailed NASTRAN model for STOP analysis.

**Inputs:** User inputs geometry, properties, constraints, and thermal loads.

**Commands:** Command line execution or batch mode available. Consult on-line manual available on the FEMCI site (http://femci.gsfc.nasa.gov/stocs/) for detailed command listing.

**Limitations:** All structures and substructures must be constrained in a stress free configuration.

**Location:** On the SGI's at /usr/local/bin/stocs

**Contact:** Jeff Bolognese/GSFC 542
Clifton Jackson/GSFC
Reg Mitchell/GSFC 542

**Reference:** http://femci.gsfc.nasa.gov/stocs/

# THDEF

**Functionality:** Program calculates theoretical displacements for comparison with NASTRAN results for a unit temperature increase (UTI) validity check.

**Inputs:** Sorted NASTRAN bulk data deck.

**Commands:** User enters the input file name, and a name for the output file with the theoretical displacements. The program prompts the user for a CTE value, thermal loading (bulk temperature change and/ or thermal gradients), and constraints.

**Limitations:** Structure must be constrained with a kinematic mount. Single coefficient of thermal expansion must be used for all materials. Program does not allow for local coordinate systems. Limited to 100000 grid points in model.

**Location:** On the SGI's at /home/jdj542/bin/thdef

**Contacts:** Reg Mitchell/GSFC 542

# UAIMODAL

**Functionality:** Reads modal effective weight (EFW) data from a UAI/NASTRAN .prt file and outputs results in a formatted table.

**Inputs:** UAI/NASTRAN normal modes analysis output (.prt) file.

**Commands:** Command line execution or GUI. User inputs name of .prt file and program outputs EFW results table (echoed to screen and saved as a file).

**Limitations:** Requires the use of DMAP (mp_v20.dmp) for calculation of EFW data. Program is UAI/NASTRAN specific. Output titles only reflect units of lbs and lbs-in$^2$.
Max number of modes = 500
Max frequency = 9999.99 Hz

**Location:** ftp://analyst.gsfc.nasa.gov/jonathan/perl/uaimdl_v1.0.zip OR
http://femci.gsfc.nasa.gov/modal_wtc/uaimdl_v1_0.zip

**Contacts:** Scott Gordon/GSFC 542
Jonathan Kuhn/GSFC 542

**Reference:** http://femci.gsfc.nasa.gov/modal_wtc/uai_mmp.html

# Summary

- Engineering utility software available to GSFC structural analysts reviewed.

- Check out the FEMCI web site!
  - Additional information for many of the engineering utility programs is available in the FEMCI book: http://femci.gsfc.nasa.gov /femcibook.html
  - Supplemental information gathered in preparation for this presentation will eventually be posted as well.

- Potential topics for further discussion:
  - Commercial utility software
    - Pre/Post Processing Software
    - TCON
    - Others ?
  - Future needs for new utilities